Cloud AR in 5G Era

Dr. Chih-Lin I
Chief Scientist, CMRI

AR Will Reshape Verticals And Daily Lives

Revolution in Human-Computer Interaction and AR will enhance human perception, cognition and execution eventually.

Engineering

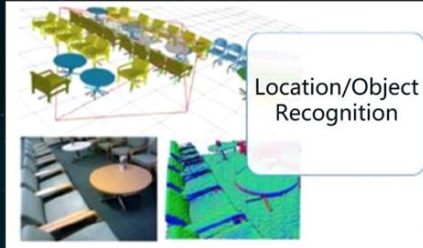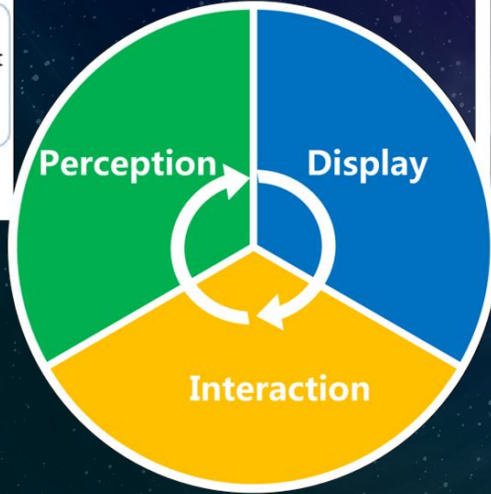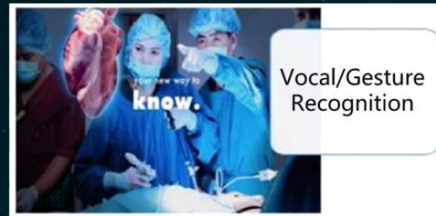**Education**

Healthcare

**Entertainment
Smart Home
Security
......**

Cloud AR Are Driven by a Need: highly complex processing

Recognition Precision

Location/Object Recognition

Graphic Quality

3D Construction /Rendering

Interaction

Perception

Display

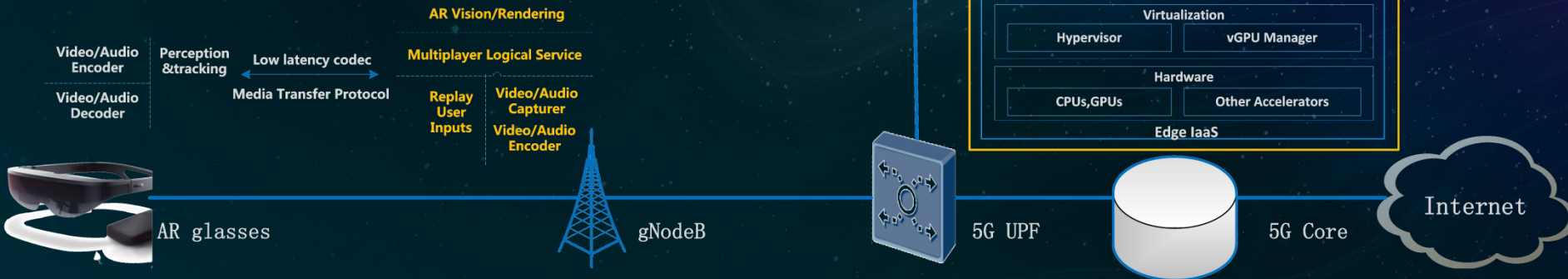**Latency**

Vocal/Gesture Recognition

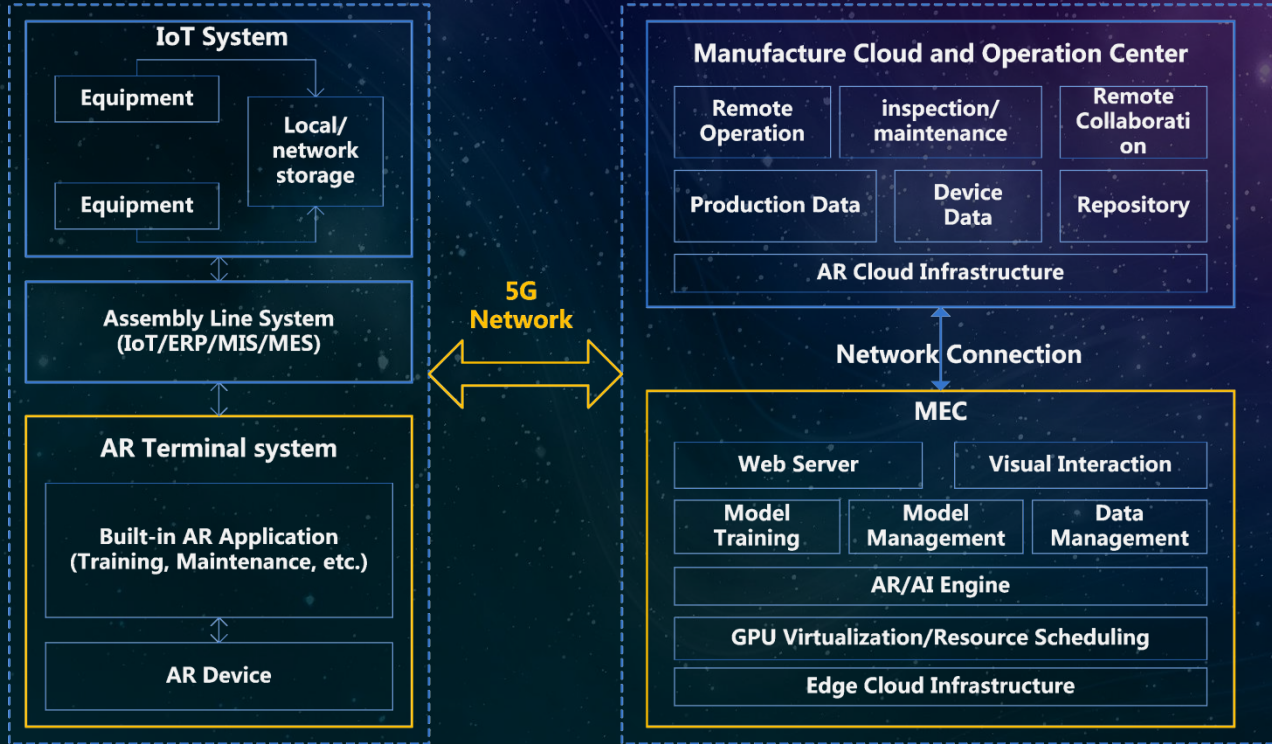**Computing power** is crucial for better customer experience.

5G Cloud AR Architecture

Key Parameters With Different Graphic Quality

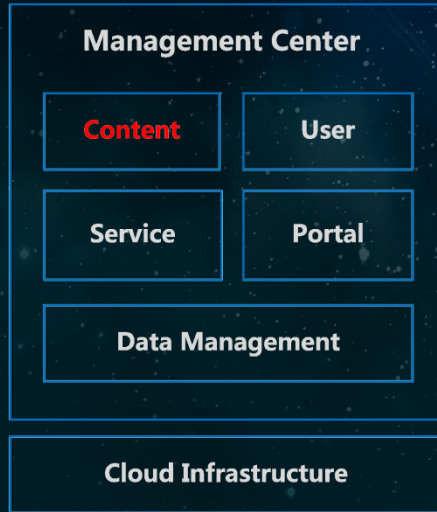|	Resolution	Frame Rate (FPS)	Compression	Uplink Bandwidth (Mbps)	Downlink Bandwidth (Mbps)
Multi-people interactive AR application	1080P	30	H.265	2	4
	2K (2560*1440)	60	*D	6	60
	4K (3840*1920)	90	*D	10	100
	The resolution here is binocular resolution and *D indicates the low latency encoding industry standard.				

中国移动
China Mobile

MEC Server

Engineering | Education | Healthcare
Graphics Driver | Graphics Driver | Graphics Driver
VM/Container | VM/Container | VM/Container
Edge SaaS

Vision/Rendering Engine
2D/3D Recognition | 3D Reconstruction | Other AR/AI Interfaces
Real-time Data Service
Data Storage | Data Processing | Data Visualization
Edge PaaS

Virtualization
Hypervisor | vGPU Manager
Hardware
CPUs,GPUs | Other Accelerators
Edge IaaS

Video/Audio Encoder
Perception &tracking
Low latency codec
Media Transfer Protocol
Video/Audio Decoder

AR Vision/Rendering
Multiplayer Logical Service
Replay User Inputs
Video/Audio Capturer
Video/Audio Encoder

AR glasses
gNodeB
5G UPF
5G Core
Internet

5G Cloud AR Solution-Manufacture

中国移动 China Mobile

IoT System

- Equipment
- Equipment
- Local/network storage

Assembly Line System (IoT/ERP/MIS/MES)

AR Terminal system

Built-in AR Application (Training, Maintenance, etc.)

AR Device

5G Network

Manufacture Cloud and Operation Center

Remote Operation	inspection/maintenance	Remote Collaboration
Production Data	Device Data	Repository

AR Cloud Infrastructure

Network Connection

MEC

Web Server	Visual Interaction

Model Training	Model Management	Data Management

AR/AI Engine

GPU Virtualization/Resource Scheduling

Edge Cloud Infrastructure

- Support various ISO/ECMA standards of the assembly line system.
- Information processing using Big Data, AI and industry specific models and tools.
- Incooperating domain-specific information from the manufacture cloud.
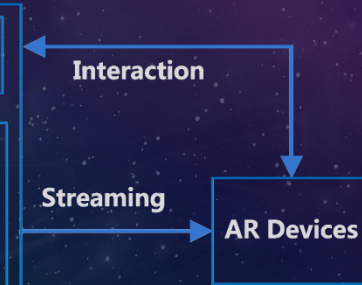
# 5G Cloud AR Solution-Education

Central Management Platform

Management Center

Content | User

Service | Portal

Data Management

Cloud Infrastructure

Edge Platform

AR Service

Service Layer

Logic Processing | AI | Streaming

Rendering

Edge Cloud Infrastructure

AR client

Interaction

Streaming
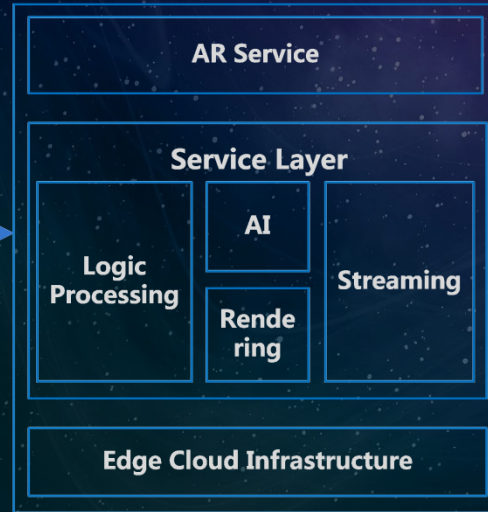
AR Devices

- Integrating digital curriculum and the central management platform.
- Enhance teacher-student interaction both locally and remotely via edge cloud and AR devices.
- Enhance classroom and/or remote collaboration: group of students with AR devices jointly explore collective learning, improve team project, etc.
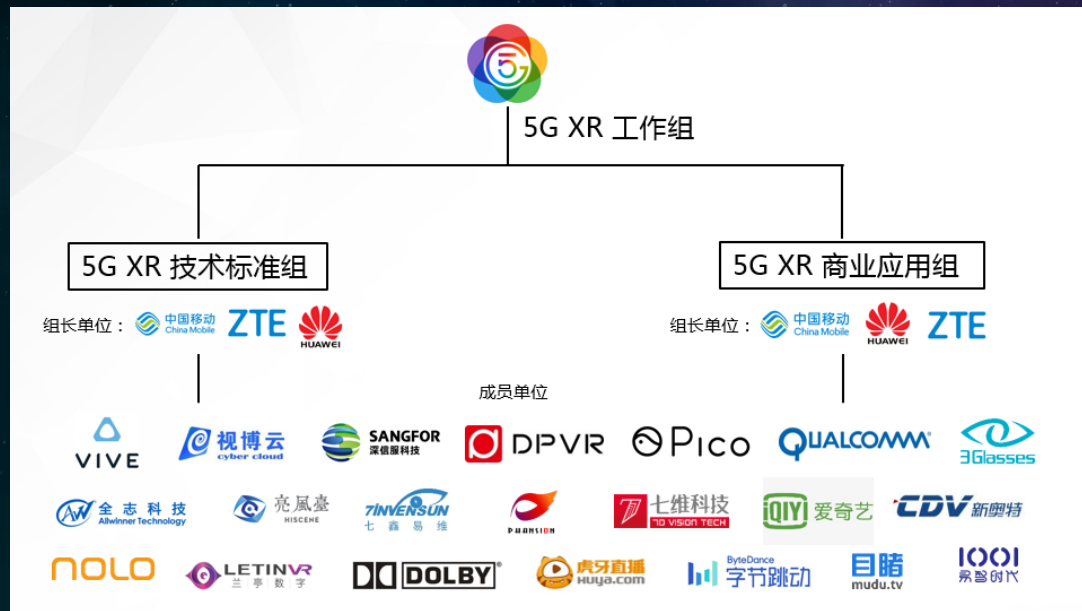
5G-Assisted Ubiquitous Screen
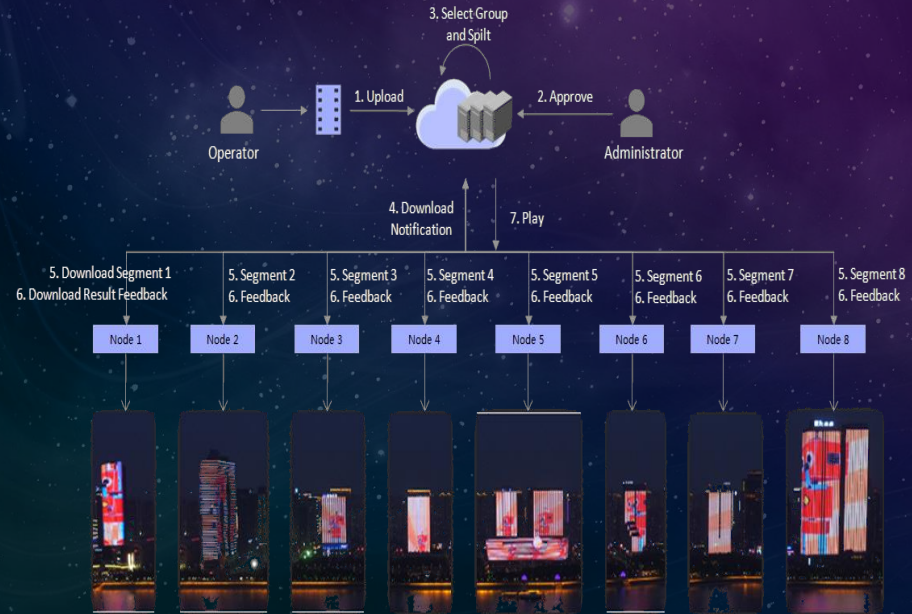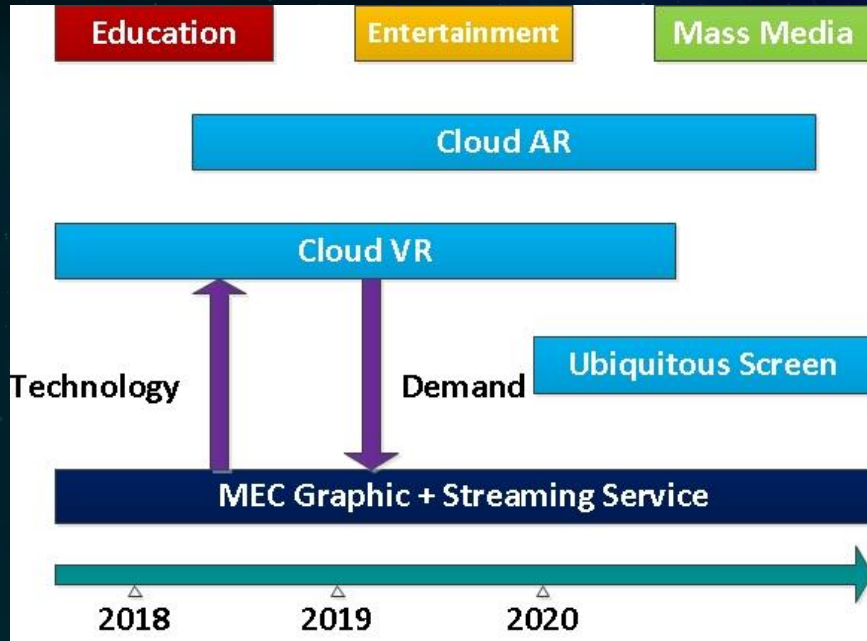
- **Ubiquitous Display, Digital Twin City, Data Visualization service in 5G era.**
- **Integration of communication technology and computer vision/graphic technology.**

5G Cloud XR Working Group

1. R&D: Solving the end-to-end technical challenges and bring the key technologies into Standardization.

2. Solution: Promoting cross-industrial collaboration to conduct commercial trials

Thank you !